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CODE OF PRACTICE FOR AMENITIES IN HYDROELECTRIC POWER HOUSES

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CODE OF PRACTICE FOR AMENITIES IN HYDROELECTRIC POWER HOUSES

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Indian Standard

CODE OF PRACTICE FOR AMENITIES IN HYDROELECTRIC POWER HOUSES

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 February 1984, after the draft finalized by the Hydroelectric Power House Structures Sectional Committee had been approved by the Civil Engineering Division Council.

0.2 Due consideration should be given to various amenities in designing hydel power stations. Provision for adequate lighting, water supply and sanitary arrangements, communication, etc, becomes necessary in the power house building for proper functioning of power stations.

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1. SCOPE

1.1 This standard covers the requirements of lighting, sound control, sanitary arrangements, water supply, communication facilities, elevators and ventilation inside medium and major power houses including pumped storage installations, and the methods of providing the same.

2. LIGHTING

2.1 General — Adequate illumination should be provided in different locations of the power house to meet the requirements of service units housed therein. Illumination facilities should, as far as possible, be in harmony with the general architecture of the structure.

2.2 In store rooms, it is sufficient to provide light to enable one to see easily, but in areas such as offices, control room, etc, visual comfort with a minimum of eye strain should be given due consideration. In such cases, it is necessary not only to provide sufficient amount of light but also to select suitable quality of lighting fixtures. For this, the light source should be such to create minimum glare, it should be kept away from the direct line of vision, and its brightness should be of low value.

2.3 An important aspect of lighting is to select proper colour scheme for the walls, ceiling, floor and equipment so as to reduce the brightness

contrast between adjoining surfaces to a minimum and at the same time avoid gloomy effects. Glossy paints and highly polished surfaces, especially those of metal, are often a source of irritation to eye and should be avoided. Improper location of windows and glass partition may also be source of visual discomfort and should be given proper consideration.

2.4 In the event of sudden failure of electric supply, it is necessary to have provision for emergency lighting at key points. Main emergency lighting shall be fed from ac supply wherever emergency station generator is available and arranged to be automatically switched on to dc supply in case of failure of ac supply.

2.5 Illumination Levels — Illumination intensities in lux which should ordinarily be used at various locations are given in Tables 1 and 2. Special circumstances may require intensities higher than those listed. The intensities listed are the average illumination values maintained on a horizontal plane 75 cm above the floor.

2.6 Lighting Fixtures — The choice of lighting fixtures, apart from the considerations mentioned in **2.1** to **2.5** should also be based on the total economics of the installation over a period of time including the annual costs of energy and maintenance. The types of lighting fixtures shall conform to latest relevant Indian Standards.

2.7 Wiring — All wiring joints shall be made in the junction boxes provided for the purpose through porcelain connectors. Screws in the porcelain connectors shall be kept tight and smeared with plastic compound to prevent entry of moisture. Temporary connections, straps or wires shall be repaired promptly. Untidy porcelain connectors with loose screwed connectors may be a potential source of trouble and shall be avoided.

2.7.1 Additional plug points shall be provided in offices, erection floor, generator and turbine floors, turbine pits, generator housing, turbine inlet valve floor, inspection and dewatering galleries, compressor room, gantry and transformer deck, sump and first aid rooms for special lighting and power requirements.

3. SANITARY ARRANGEMENTS

3.1 Adequate toilet facilities shall be provided to serve the personnel working inside the power station and those visiting from outside. Sewerage and waste water from all the toilets shall be collected through a well laid out system of sanitary pipes and drains and carried to a septic tank of suitable capacity. The effluent from the septic tanks shall be duly disinfected before its disposal into the tail race. Digested sludge shall be

disposed off by sludge pumps. Alternatively, chemical toilets with arrangement for proper disposal of waste may be provided [*see* IS : 2470 (Part 1)-1968* and IS : 2470 (Part 2)-1971†].

TABLE 1 RECOMMENDED ILLUMINATION INTENSITIES

(*Clause* 2.5)

Sl No.	Location	Intensity of Illumination Lux
(1)	(2)	(3)
i)	Corrridors, strairways and toilets	70 to 100
ii)	Offices/ laboratory/library/conference room	300
iii)	Reception rooms	150
iv)	Erection floor, turbine pits and workshops	200 to 300
v)	Generator and turbine floor	200
vi)	Generator housing	100
vii)	Control rooms	200 to 300
viii)	Cable galleries, air compressor rooms, oil storage rooms and duplex strainer room	70 to 100
ix)	Storage areas, oil purifier rooms, battery room, ventilation and air conditioning equipment rooms, carbondioxide rooms and tool room	100
x)	Maintenance shops	250 to 400
xi)	Pump and water treatment room	125 to 175
xii)	Transformer room	100
xiii)	Gantry and transformer deck (outdoor)	10 to 35
xiv)	Turbine inlet valve house/floor	75 to 110
xv)	Electrical, switchgear rooms and operating galleries	100
xvi)	Pipe galleries	90 to 125
xvii)	Inspection and dewatering galleries	45 to 90
xviii)	Sumps	30 to 55
xix)	Telephone equipment room	200 to 325
xx)	First aid room	300 to 450
xxi)	Switch yard (floodlighting)	20 to 30
xxii)	Floodlight illuminated areas	5 to 35

*Code of practice for design and construction of septic tanks: Part 1 Small installations (*first revision*).

†Code of practice for design and construction of septic tanks: Part 2 Large installations (*first revision*).

TABLE 2 RECOMMENDED ILLUMINATION INTENSITIES FOR EMERGENCY (DIRECT-CURRENT) LIGHTING

(*Clause* 2.5)

Sl No.	Location	Illumination Lux
(1)	(2)	(3)
i)	Battery and telephone equipment rooms	20 to 35
ii)	Carbondioxide room	One 100 W lamp
iii)	Control panels	50 to 110
iv)	Operating galleries	One 100 W lamp
v)	Turbine generator rooms, switchgear rooms and transformer rooms	100 to 125
vi)	Staircases	10 to 25

3.2 Location — Toilets shall be provided on each floor perferably on one side of the power station building. However, if the length of power house is very long and site conditions permit, location of toilet at more than one point may be considered. Separate toilet should be attached with the control room, committee room, rest room, reception, etc. Toilets at different floors should preferably be located directly one above the other so as to make piping system easy.

3.3 Toilet Facilities — Sufficient number of urinals including squatting type water closets and wash basins with mirror shall be provided.

4. WATER SUPPLY

4.1 Water supply is required in the power station for various service utilities such as cooling, fire fighting, flushing and for drinking purposes. The arrangement of water supply shall be made according to the requirements of various equipment, size of the power station and the toilet facilities provided therein. The water pipe lines shall be of mild steel, PVC or HDPE pipes and shall be supported on clamps fixed on the walls. Normally, these pipe lines should run along with the pipe lines of compressed air, oils, etc, each painted with different colour. The piping

should be provided with flexible couplings at the location of expansion/ contraction joints (*see* IS : 2065-1972*).

4.2 Drinking Water Facilities — Drinking water fountains should, as far as possible, be provided at the following locations of the power stations:

a) Reception rooms, and

b) In the vicinity of offices, control room, maintenance shop and wherever else required. Two to three drinking water fountains installed at suitable locations should be quite sufficient to cater the needs of a power station.

4.2.1 Generally one water cooler with twin tap arrangement of sufficient capacity shall be installed at each of the places (that is reception room, main control room, relay and switchgear room, generator floor and turbine floor) or in vicinity inside the power station.

4.3 Cooling, Sealing and Fire Fighting Water Supply — Water supply is needed in a power station for cooling of the transformers, bearings of the turbines and generators. Water supply is also needed for sealing purposes and for fire fighting system. The quality and purity of this water shall be decided in accordance with the requirements of the machines and equipment and suitable arrangement for treatment of water shall be made for ensuring clean water supply for specific purposes. Besides other sources, this water may also be made available from any of the following sources:

a) Pumping from the tailrace,

b) Tapping from the penstock (the inlet pressure in this case will be approximately equal to the head on the turbine and pressure reducers/boosters may be needed to bring it to the required level, and

c) Pumping from forebay.

5. ELEVATORS

5.1 Elevators with suitable capacities may be provided in power houses to cater for working personnel and transportation of light equipment. The elevators should preferably be provided in vicinity of the erection floor.

*Code of practice for water supply in buildings (*first revision*).

6. COMMUNICATION FACILITIES

6.1 A wireless system in addition to other normal communication system designed to serve the following main functions shall be provided in a power station:

a) To provide local communication between various parts of the power station building and outside structures, such as switchyard, penstock valve house, dam, spillway, head regulator gates, intake/bypass gates, escapes, etc.

b) To provide quick and reliable communication between the control room operator and certain key points in and around the power plant and to the authorities.

c) To provide terminals for telephone and carrier telephone circuits from other power stations and distant points, including commercial long distance lines.

6.2 Local communication in and near a plant may be provided by a small independent automatic telephone exchange preferably with underground cabling.

6.3 Postal telephone circuits and carrier current telephone circuits from other power stations or sub-stations may be terminated on the same control-room switch board used by the power plant operators for communication with local key points with suitable protection for lines exposed to inductive interference. Physical telephone circuits may be of the magneto or common battery type. The magneto type is more suitable for long lines having several telephones. Voice frequency extensions from a carrier current set may be of magneto, common battery, manual or automatic type. The type to be used in each case shall depend on the type of the telephone system to which the extensions connect. Magneto type extensions with push-button or magneto ringing are prefered, since they are simpler than other types.

6.4 In large power stations where considerable telephone traffic is expected, an additional manual switch board to superwise incoming and outgoing calls, especially long distance calls, may be provided. All telephone lines connected to postal telephone system shall pass through the switch board. In addition, all local lines from the automatic switch board, and all the lines from the control room switch board should be connected in multiple to the PBX so that the operator could assist in making the desired connections, provide information, and perform other special services.

7. SEISMIC ALARM TRIPPING DEVICE

7.1 Adequate allowance shall be made for seismic forces in the design of hydroelectric power houses. The magnitude of such forces depends on both the amplitude and the frequency of the induced waves. Seismic forces cause random motion of ground which may be resolved in any three mutually perpendicular directions. This motion causes the structure to vibrate. The predominant directions of vibration is horizontal. To trip off electrically the generators installed in the power house in the event of an earthquake exceeding the threshold level which is pre-set, an instrument, seismic alarm tripping device, may be installed. Details of a typical equipment and its maintenance are given at Appendix A.

8. NOISE CONTROL

8.1 The turbine floors of hydroelectric power stations and specially of those with half embedded scroll case are generally quite noisy. In order to maintain comfortable working conditions, following measures should be employed:

a) Control-room, telephone-room, office, etc, should be segregated from the machine hall by providing sound-proof partitions;

b) Control-room, telephone-room, offices, corridors, etc, may be provided with rubberised floor tiles and acoustic tiles in the false ceilings; and

c) Air intake and exhaust openings provided for ventilation should be large enough to keep the noise level low.

9. VENTILATION

9.1 Adequate ventilation shall be provided in the power house buildings and shall be in accordance with IS : 4720-1981*.

APPENDIX A

(*Clause* 7.1)

TYPICAL SEISMIC ALARM TRIPPING DEVICE

A-1. DETAILS OF EQUIPMENT

A-1.1 The instrument consists of two independent units: (a) sensing and starting unit, and (b) electrical equipment consisting of suitable relays,

*Code of practice for ventilation of surface hydel power stations.

electronic circuit, indicators, etc. The sensing unit consists of three starting pendulums, having natural frequency of 6 to 7 H_z and damping about 60 to 70 percent. The three pendulums are for (horizontal, longitudinal and transverse) and vertical directions, so that the earthquake motion of any direction is sensed by this unit, which in turn triggers the electrical unit to perform the required functions. The threshold/triggering level may be adjusted to any predetermined value.

A-1.2 The electrical unit which contains the electronic circuit, relays and indicators, operates the required functions when it receives a signal from the starting unit. Normally, a small indicating lamp is always 'ON', indicating that the equipment is in working order. This is through a 'NORMALLY CLOSED' relay. When a signal is received, this relay is automatically operated and the indicating lamp is put 'OFF'. The operative contacts of this relay are taken out and outputs of relays or switches from generators may be connected to these terminals to put 'OFF' these items.

A-1.3 Simultaneously another relay which has 'NORMALLY OPEN' contacts is put to 'ON' condition and a 'RED LAMP' and a 'SIREN' installed in the vicinity are put 'ON' for a minute from the time of receipt of first signal. Thus the persons in the vicinity are altered in the event of earthquake and may take necessary precautions for the safety of human life and equipment.

A-1.4 A third relay which has changeover contacts also operates simultaneously, which is used for latching purposes. This relay will latch the first relay only for the purpose that the terminals to which the outputs of the generators are connected is latched in 'OFF' position. Thus at the end of one minute the indicator will be 'ON' indicating that the earthquake is over, but the outputs of generators will remain 'OFF'. This will be put 'ON' only after a 'RESET' button is pressed manually.

A-1.5 The sensing and starting unit which contains pendulums for all the three directions, is installed in such a place, which is free from vibrations created by the generators in the power houses, otherwise the instrument may receive the false triggerring.

A-2. MAINTENANCE

A-2.1 Practically no maintenance is required after installation except that the batteries are kept in fully charged condition for faithful operation of the equipment.